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NEOTYPE DESIGNATION OF *CULEX QUINQUEFASCIATUS* SAY (DIPTERA: CULICIDAE)

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Abstract.—To promote nomenclatural stability concerning the interpretation and use of the name *Culex quinquefasciatus* Say for the southern (tropical) house mosquito, a neotype male is here designated. It was chosen from a series of specimens reared from an egg raft, collected in 1969 at New Orleans, Louisiana, USA. Description and illustrations of the *quinquefasciatus* male, female and associated pupa and larva are provided. Under the Law of Priority, the name *quinquefasciatus* Say 1823 takes precedence over all accepted junior synonyms, notably *fatigans* Wiedemann 1828.

In the intervening two decades since the name *Culex quinquefasciatus* Say (1823:10) was discussed by Stone (1956 [1957]:342–343) and adopted by Stone et al. (1959) as the valid name for the southern (tropical) house mosquito, some significant contributions have been made towards an objective resolution of the nomenclatural arguments concerning this well known taxon. Fundamental to the solution of this problem is the identity and nomenclatural status of the only surviving mosquito specimens that were collected by Thomas Say. These were sent by Say to Wiedemann between 1823 and 1828 and later were deposited in the Naturhistorisches Museum in Vienna. Among this material are specimens which Wiedemann (1828:12–13) described as *Anopheles ferruginosus*. In a footnote he stated that the description was based on "original" specimens of *Culex quinquefasciatus* (i.e., material from Say but not necessarily type-material, see Belkin, 1977:44).

In 1905, L. O. Howard (*in* Coquillett, 1906:7) examined four specimens labelled as *ferruginosus* and reported that they were *Culex*, not *Anopheles*. This discrepancy has led subsequent culicidologists to suspect or speculate that some of the specimens in the type-series of *ferruginosus* may represent the original material from which Say (1823:10–11) drew his description of *quinquefasciatus*. If this were the case it would be possible to select and designate one of these specimens as a lectotype of *quinquefasciatus*, thus removing all doubts about the identity of the species to which this name has been applied.

In an attempt to clarify and to resolve the above and other intimately related problems, Belkin (1977:45–52) critically reexamined all existing Say material of mosquito species described by Wiedemann (*ferruginosus*, *crucians* and *pungens*) at the Naturhistorisches Museum in Vienna in the summer of 1966. Of the 4 so-called *ferruginosus* specimens mentioned by

Coquillett (1906), Belkin found only 3 with determination labels from Wiedemann. These 3 specimens represent an *Anopheles* species conforming to Wiedemann's description of *ferruginosus* but not to Say's description of *quinquefasciatus*. The fourth specimen lacks a definite determination label, and was identified by Belkin as *Culex*. As discussed by Belkin, Howard probably saw this specimen; but, as it bears no Wiedemann labels, it cannot be taken as type-material of any species described by Wiedemann, particularly *Culex pungens* to which it apparently belongs. This information rules out any possibility of designating a lectotype of *quinquefasciatus* from the existing *ferruginosus* syntype series.

The type-specimens of *Culex pungens*, and Wiedemann's description of this species, agree perfectly with Say's description of *quinquefasciatus* and it appears possible that *pungens* might have been described from original specimens of *quinquefasciatus*. However, as the *pungens* type-specimens cannot be proven to have come from Say, their standing in relation to *quinquefasciatus* is equivocal. Based on these lines of argument, derived from his examination of the *ferruginosus* and *pungens* material, Belkin (1977) concluded that the *ferruginosus* specimens are unacceptable as the original material (type) of *quinquefasciatus* and that Wiedemann's description of *pungens* was probably based on the specimens of *quinquefasciatus*. Other information from the description and labels of Wiedemann's species indicates New Orleans as the origin of the Say material. Although the exact locality of *quinquefasciatus* cannot be determined from Say's notes, it is safe to assume that some of the original material may have come from somewhere in the vicinity of New Orleans to where the type-locality was restricted by Belkin, Schick and Heinemann (1966:4–5).

From a careful consideration of the involved problems fully discussed by Belkin (1977) we are satisfied that none of the material from Say, as used for the description of *ferruginosus* Wiedemann, is eligible for designation as lectotype of *quinquefasciatus*. The rest of Say's original material is no longer existent in the United States. Harris, who studied the Thomas Say collection shortly after Say's death, reported that the Diptera were entirely destroyed (Weiss and Ziegler, 1931). Thus there seems to be no possibility that other original type-material of *quinquefasciatus* will be found for proper lectotype designation.

We also concur with Belkin (1977) that, since none of the *Anopheles ferruginosus* specimens can be considered as the original material (type) of *Culex quinquefasciatus*, a suitable neotype from New Orleans should be designated in order to clarify and to stabilize the nomenclature. In accord with the interpretation by Stone (1956 [1957]), as adopted in both editions of the World Catalog of mosquitoes (Stone et al., 1959:254; Knight and Stone 1977:217) and as analyzed further by Belkin (1968b:47; 1977: 45–52), we recognize that the original description of *quinquefasciatus* by Say (1823:10–11) applies to the *Culex* species commonly known as the

tropical or southern house mosquito. Furthermore, it seems highly unlikely that Say, who described 6 North American Culicidae in the years 1823–1827, would have failed to name this familiar pest, and none of his other descriptions could readily be confused with it. In accordance with the Law of Priority (Article 23, International Code of Zoological Nomenclature, 1964:23; 1974:79–81), therefore, the name *quinquefasciatus* Say 1823 takes precedence over all accepted junior synonyms, notably *fatigans* Wiedemann 1828 (see Knight and Stone, 1977:217–219 for complete synonymy).

In support of previous and present interpretations of the name *quinquefasciatus*, the original description given by Thomas Say is reproduced in Fig. 1.

Neotype Designation and Depository

Neotype ♂ (No. 9) with associated pupal and larval skins and slide of genitalia (No. 691013-1), reared from an egg raft collected on 18 September 1969 in New Orleans, Louisiana, U.S.A., by personnel of the New Orleans Parish Mosquito Control (George T. Carmichael, director); to be deposited in the U.S. National Museum, Washington, D.C. (USNM).

Other specimens reared from the same egg raft as the neotype have been deposited in the following institutions:

(1) British Museum (Natural History), London, Great Britain: 1♂ (No. 11) with associated pupal and larval skins and genitalia slide (No. 691013-2), 1♀ (No. 2) with associated pupal and larval skins and 2 whole larvae.

(2) Services Scientifiques Centraux, O.R.S.T.O.M., Bondy, France: 1♂ (No. 17) with associated pupal and larval skins and genitalia slide (No. 691013-3), 1♀ (No. 5) with associated pupal and larval skins and 2 whole larvae.

(3) Australian National Insect Collection, C.S.I.R.O., Canberra, Australia: 1♂, with slide of genitalia (No. 760318-1), 1♀ (No. 8) with associated pupal and larval skins and 2 whole larvae.

(4) Department of Entomology, National Science Museum, Tokyo, Japan: 1♂ with slide of genitalia (No. 760318-4), 1♀ with associated pupal and larval skins and 2 whole larvae.

The rest of the material in this series, which consists of 8♂ (3 with genitalia slides No. 760329-2, 3, 5), 4♀ with associated pupal and larval skins (No. 1, 15, 16, 18), 12♀ (2 with slides of cibarial armature No. 760329-1, 2) and several whole larvae are placed in the collection of the USNM. These specimens are available for deposition in other museums upon request.

Description and Illustrations

The description and illustrations of *quinquefasciatus* presented here are composite and comprehensive, based on a detailed study of the neotype and

2. C. 5-*fasciatus*. Body cloathed with cinereous hair; abdomen annulate with blackish.

Inhabits the western states.

Eyes **deep black;** ***antennæ*** **fuscous, region of the base paler;** ***proboscis*** **black;** ***thorax*** **with a dilated dorsal fuscous vitta;** ***pectus*** **each side varied with blackish;** ***halteres*** **entirely whitish;** ***scutel*** **glabrous:** ***wings*** **with dusky nervures, immaculate;** ***feet*** **moderate, fuscous;** ***thighs*** **whitish;** ***abdomen*** **cinereous;** ***tergum*** **with five black, broad, fasciæ;** ***tail*** **black above.**

Length about one-fifth of an inch; proboscis one-tenth of an inch.

This is an exceedingly numerous and troublesome species. We found them in great numbers on the Mississippi in May and June. The hairy covering is very deciduous, and when an individual is caught by hand, the back of the thorax, in consequence of being denuded by the touch, exhibits the dorsal vittæ of a blackish colour confluent at the base, with an oval black spot on each side. The abdominal annuli are sometimes fuscous or even light brown.

Legs **much shorter than those of the preceding species, but like them in not being annulated.**

Fig. 1. Reproduction of the original description of "Culex 5-fasciatus" as published by Say, 1823:10–11.

all other specimens in this series. Altogether, 43 specimens (13 males, 20 females, 10 fourth instar larvae) and 11 associated pupal and larval skins have been examined. The descriptive terminology used follows Belkin (1962, 1968a) and Belkin et al. (1970). For a brief diagnosis of the adults and im-

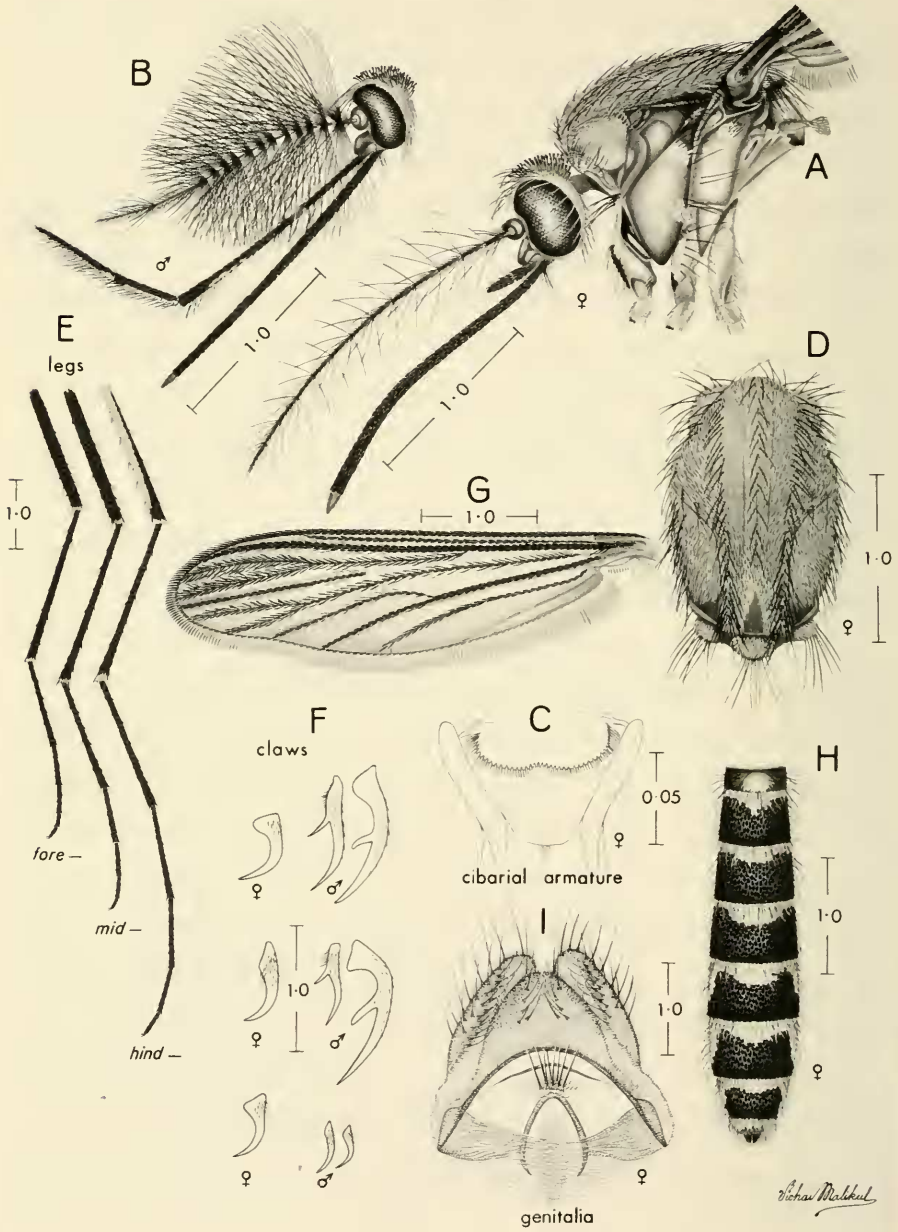

Fig. 2. *Culex quinquefasciatus*. A, female head and thorax, lateral view; B, male head, lateral view; C, female cibarial armature; D, female thorax, dorsal view; E, legs, anterodorsal views; F, male, female tarsal claws; G, wing, dorsal view; H, female abdomen, dorsal view; I, female genitalia.

matures of *quinquefasciatus*, consult Belkin (1962, 1968a), Bram (1967) and Sirivanakarn (1976).

Male (Fig. 2).—Measurements based on neotype. Wing 3.6 mm. Forefemur 1.8 mm. Proboscis 2.7 mm. In general as described for female except for the following. Head: Palpus exceeding proboscis by full length of segment 5; segments 2 and 3 entirely dark scaled; segment 3 sometimes with a few pale scales on lateral surface in middle, apical 0.25–0.40 with a ventrolateral tuft of 10–12 dark bristles, ventral surface with a row of several short, pale hairlike setae extending from base to apex; segments 4 and 5 entirely dark scaled on dorsal surface, lateral, ventral and mesal surfaces with numerous bristles; ventral surface of segment 4 with a pale scaled line from base to about 0.75 of total length; ventral surface of segment 5 with a distinct pale scaled spot at base. Proboscis entirely dark scaled or sometimes with a poorly defined pale ring at false joint which is located at about 0.75 of the length from base. Antenna shorter than proboscis, flagellar whorl long, densely plumose. Legs: Claws of fore- and midlegs enlarged, external claw larger than internal, both with a distinct subbasal denticle; claws of hindleg small, equal and simple. Wing: Scales on branches of veins R, M and Cu less dense than those in the female. Abdomen: Tergites II–VII with complete, evenly broad basal pale bands, all of which are connected with basolateral pale spots laterosternad; length of basal band about ⅛ of segment width.

Male genitalia (Fig. 3A).—Segment IX: Tergal lobe poorly developed, with 1–2 irregular rows of 10–12 strong setae; sternum broad, finely spiculate, without setae or scales. Sidepiece: Slender, conical, about 0.35 mm in length; inner tergal surface with 1–2 irregular rows of about 15 subequally strong setae extending from basal ⅓ to slightly beyond level of subapical lobe; lateral tergal surface with about 20 heavy bristles and several weaker bristles; apex with a row of 6–7 setae on sternal surface. Subapical lobe: Broad; specialized setae of proximal and distal divisions clearly divided; proximal divisions with 3 strong rodlike setae (*a–c*) of subequal length; rod *a* straight with abruptly pointed apex; rods *b* and *c* gently curved with hooked apices; rod *c* thinner than *a* and *b*, its base more or less separated from the latter distad; distal division with 3 slender bladelike or rodlike setae in group *d–f* on mesal surface and 1 broad leaflet (*g*) and 1 strong flattened seta (*h*) on lateral surface. Clasper: simple, typically sickle-shaped, about 0.75 of length of sidepiece; outer subapical margin without distinct annulation or crest of spicules; 2 ventral tiny setae present distad of median curvature on ventral surface, dorsal seta absent; spiniform subapical, short, flattened and apically blunt. Phallosome: Apical portion of lateral plate with outer and inner divisions; median portion of outer division with a prominent apically pointed tergal mesal spine (or tergal arms of several authors) which is straight so that both spines on each lateral plate are nearly

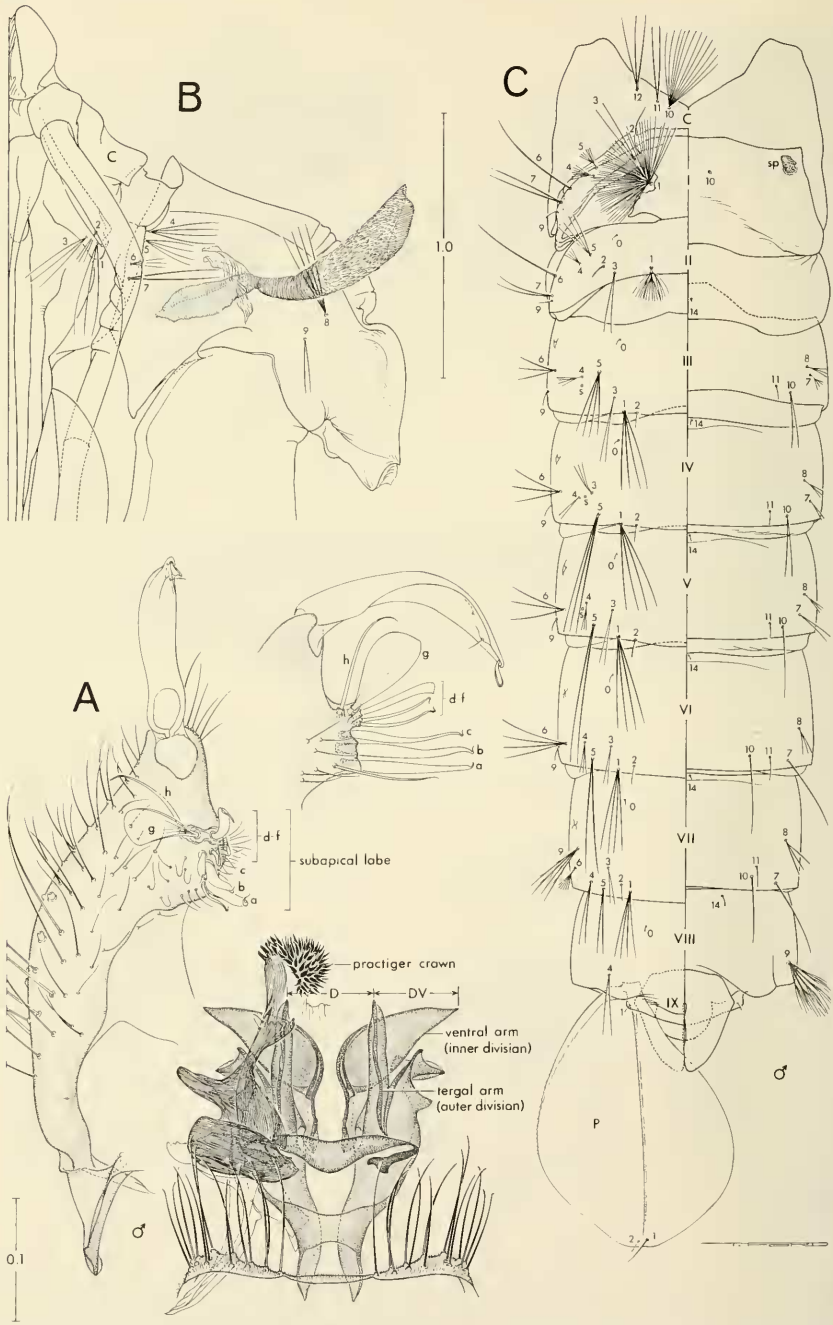

Fig. 3. *Culex quinquefasciatus*. A, male genitalia, dorsal view; B, pupa, cephalothorax, C, pupa, cephalothorax, abdomen and paddle.

parallel; lateral portion of outer division with a small or weakly sclerotized, divergent lateral spine and a small, apically rounded lateral basal process; inner division represented by a simple, broad, leaflike ventral arm which is sharply pointed and strongly divergent laterad; DV/D ratio [or distance between apices of tergal mesal spine and ventral arm (DV)/distance between apices of tergal mesal spines (D)] usually 1, varies from 0.7–1. Proctiger: Apical crown large, dark, composed of 4–5 flat and blunt spicules laterally and numerous spinelike spicules laterally and mesally; paraproct well sclerotized; basal sternal process rudimentary or poorly developed, at most 0.03 mm in length; cercal sclerite poorly sclerotized; cercal setae 3–4.

Female (Fig. 2).—Wing 4.2 mm. Forefemur 1.98 mm. Proboscis 2.3 mm. Abdomen 3.24 mm. General coloration light brownish. Head: Eyes contiguous above antennal pedicels; decumbent scales on dorsum of vertex narrow, crescent-shaped, rather coarse and predominantly pale beige in center, fine and whitish on orbital line; erect scales numerous, evenly spread, largely dark brownish except for a few pale ones in center; lateral patch of broad appressed scales whitish; frontal bristles strong, yellowish or golden; upper orbital bristles weaker, dark brownish; suborbital bristles weak, pale yellowish to dark brownish. Clypeus bare, integument dark brownish. Palpus 4-segmented, about 0.2 of proboscis length, largely dark scaled, apex of segment 4 usually tipped with some pale scales on inner dorsal surface. Proboscis completely dark scaled on labium; labial basal setae 4 with 2 lateral ones strong and as long as palpus and 2 median ones weaker and shorter. Antenna slightly shorter or as long as proboscis; pedicel with a distinct patch of semi-erect scales and setae on inner dorsal surface; flagellum 13-segmented; flagellar segment 1 with or without a few pale scales; 5–6 flagellar bristles, very weak and sparse, their length about 2× as long as one flagellar segment. Cibarial armature: Cibarial dome oval, strongly imbricate; cibarial bar evenly concave except for slight projection at middle; about 30 teeth, all short, apices blunt, truncate or abruptly pointed; 3–4 median teeth weakly developed and lightly pigmented, lateral teeth stronger and dark pigmented. Thorax: Mesonotal integument brownish or lighter, but not blackish; mesonotal scales narrow, crescent-shaped and dense, more or less uniformly pale beige or dull yellowish on disc, pale whitish on extreme anterior promontory, lateral margin of supra-alar, middle of prescutellar space and scutellar lobes; acrostichal bristles well developed in a double row from anterior promontory to near prescutellar space; dorsocentral and supra-alar bristles strong; mid-scutellar lobe with 7–8 bristles, lateral scutellar lobe with 6–7 bristles. Integument of pronotum same color as mesonotum; anterior pronotal lobe (*apn*) with 6–8 strong bristles and several pale scales on dorsal surface. Posterior pronotum (*ppn*) with a broad patch of narrow, pale beige scales on anterior upper surface; 5–6 strong, dark posterior bristles. Pleural integument paler than

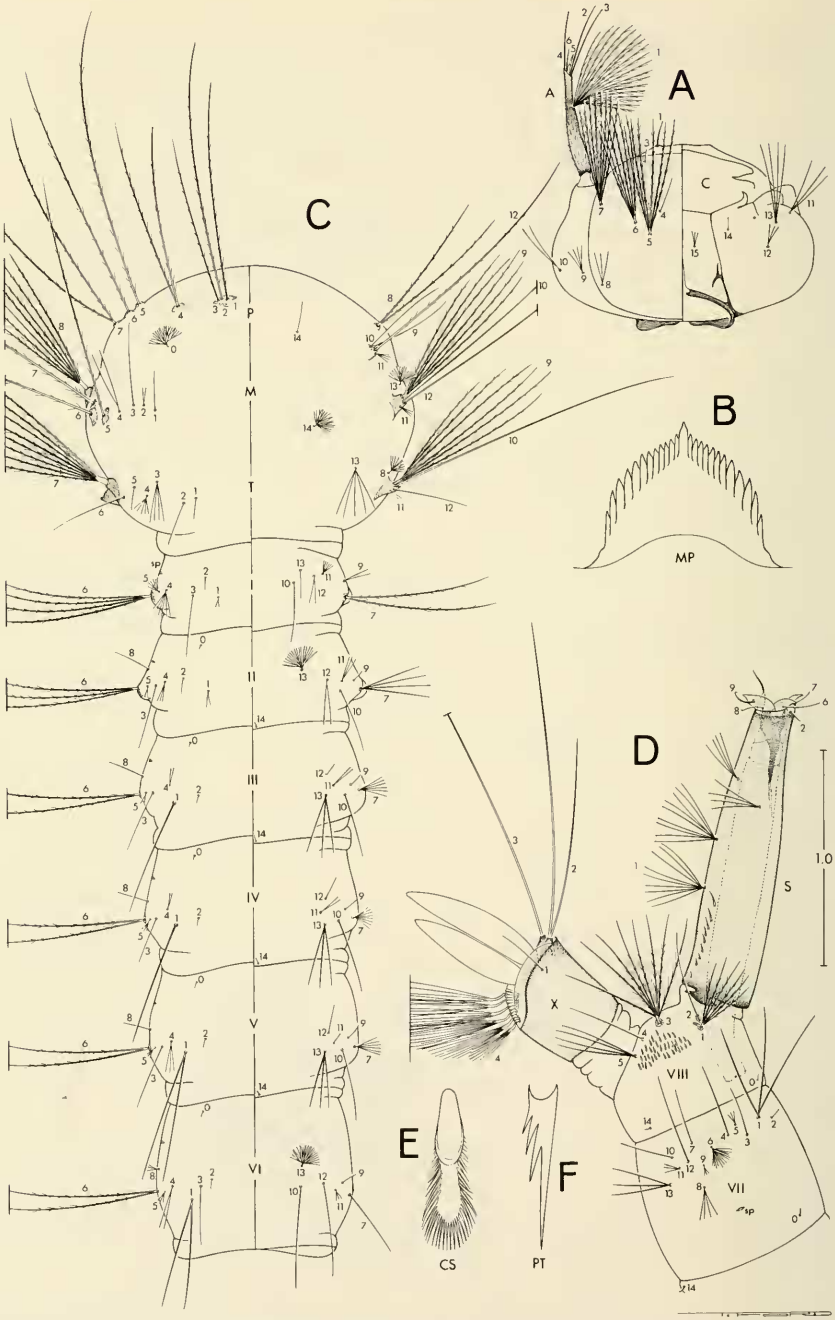

Fig. 4. *Culex quinquefasciatus*, larva. A, head; B, mental plate; C, thorax and abdomen I–VI; D, abdomen VII, VIII, siphon and saddle; E, comb scale; F, pecten tooth.

mesonotum and without definite pattern of darkened areas; whitish scale patches present, distinct, restricted to propleuron (*ppl*), sternopleuron (*stp*) and mesepimeron (*mep*); *ppl* with a small scale patch at base on lateral surface; *stp* with a broad scale patch on uppermost corner and a separate vertical scale patch along posterior border; *mep* with a broad scale patch at same level as upper corner of *stp* and several loosely packed scales among upper mesepimeral bristles; *ppl* with 5–7 bristles and 5 other weak setae; lower *mep* bristles 1–2 and sometimes 3; upper *mep* bristles about 10. Legs: Anterior surface of forecoxa with several strong, curved bristles and a broad scale patch, latter largely dark on lower surface, pale whitish, forming a distinct spot on upper lateral surface; anterior surface of mid- and hindcoxae with a narrow whitish scale patch; trochanters and bases of femora pale scaled; anterior surface of fore- and midfemora dark scaled, apex tipped with pale scales, ventral surface whitish scaled; anterior surface of hindfemur with a broad longitudinal pale stripe from base to apex, dorsal surface dark scaled, ventral surface whitish scaled; all tibiae dark on dorsal surface, apex tipped with pale scales, ventral surface pale; all tarsi completely dark or blackish scaled; claws of all legs small, equal and simple. Wing: Scales on all wing veins dark and dense; plume scales on R_2, R_3 and R_{1+5} narrow, linear; cell R_2 about 3× as long as length of R_{2+3}; furcation of cell M_2 at same level as or slightly distad of furcation of cell R_2; alula fringed with a row of 12–14 dark, narrow scales; upper and lower calypters fringed with numerous long, yellow, hairlike setae. Halter: Peduncle pale and bare; knob cupshaped, covered with several pale scales. Abdomen: Tergites II–VII with distinct basal pale bands and basolateral pale spots, latter on tergites II–V not distinct from above; tergum I with dark caudal scale patch, basal bands on tergites II–V broadened in middle, narrow laterally and not connected with basolateral pale spots; basal bands on tergites VI–VIII evenly broad and connected with basolateral pale spots or streaks which are visible from above; sternites predominantly yellowish. Genitalia: Sternite VIII with distinct median emargination; lateral caudal margin with a row of 7–8 strong, curved bristles, median caudal margin with several weaker bristles. Tergite IX narrow with an irregular row of about 10 bristles on lateral caudal margin, median portion bare. Cerci short, thumblike, about 0.15 mm in length, with numerous setae largely restricted to apical lateral surface. Postgenital plate rounded on posterior caudal margin, apical 0.5 with a double lateral row of 6–7 bristles, with 1–2 of most distal bristles strongest. Posterior cowl narrow, ribbonlike, with numerous spicules. Vaginal sclerite horseshoe-shaped or in form of a U. Sigma with a dense tuft of 8–9 strong setae.

Pupa (Fig. 3B, C).—Abdomen 3.6 mm. Paddle 0.90 mm. Trumpet 0.72 mm; index 5. Detailed chaetotaxy as figured. Cephalothorax: Yellowish white with indefinite darkened areas along margin of posterior middorsal ridge, leg and wing cases; setae 1- to 3-C triple; 5-C 4–5 branched; 8-C usu-

ally 3–4 branched (2–4); 9-C 2–3 branched. Trumpet: Meatus narrow and dark in basal 0.25, apical 0.75 gradually broadened or more or less cylindrical and pale; apical margin truncate or slightly emarginated; pinna oblique and long, 0.30–0.38 of total length. Metanotum: Darkened in middle, pale laterad; seta 10-C 8–10 branched; 11-C double; 12-C 3–4 branched (2–5). Abdomen: Segments I–IV darkened in middle, pale towards lateral margin; segments V–VIII uniformly pale yellowish to whitish; setae 3-I to 3-III double, 3-III sometimes single; 5-II and 5-III 4–5 branched; 6-I and 6-II single; 7-I and 7-II double; 1-II small, brushlike, dendritic, with 15–16 distal branches; 1-III to 1-VI subequal, 4–5 branched, 0.50–0.75 of length of segment following; 1-VII shorter, usually 4 branched (3–4); 5-IV to 5-VI strong, as long as or slightly longer than segment following; 5-IV usually triple, sometimes double; 5-V and 5-VI double; 6-III to 6-V subequal, usually triple (2–4); 6-VI stronger, usually 4 branched (3–4); 4-VII double; 9-VII usually 4 branched (3–4); 9-VIII 5–8 branched. Paddle: Very broad, hemispherical; color whitish to almost transparent; external buttress and midrib distinct, but not infuscate; outer margin smooth or minutely spiculate; setae 1-P and 2-P minute, single.

Larva (Fig. 4).—Head 0.78 mm. Siphon 1.3 mm; index 4. Saddle 0.38 mm; siphon/saddle ratio 3.3. Detailed chaetotaxy and general features as figured. Head: Broader than long; integument pale yellowish from level of ocular bulge to anterior margin of frontoclypeus, darker posteriorly, collar brownish; ocular bulge prominent; labrum narrow; seta 1-C pale, proximally flattened, distally filamentous, its length about 0.5 of the distance between bases of the pair; 4-C single, as long as or slightly longer than the distance between bases of the pair; 5-C and 6-C usually 5 branched (4–6), strong, subequal, their apices reaching slightly beyond mouthbrush; 7-C 8–10 branched, slightly shorter than 5-C and 6-C; 13-C 4 branched; 14-C single; 16-C and 17-C not developed. Antennal shaft 0.50–0.75 of head length, straight or weakly curved outward in middle; proximal portion with numerous strong spicules, distal portion beyond base of setae 1-A with or without a few spicules; pigmentation same as head capsule; 1-A large, fan-shaped, with about 22 strongly pectinate branches; 2-A and 3-A single, bristlelike and pale, both situated subapically. Mental plate brownish, with 10–13 lateral teeth on each side of a median tooth. Mouthbrush composed of numerous long, yellowish filaments. Thorax: Integument glabrous; setae 1-P to 8-P strong, subequal, 1-P to 3-P single; 4-P double; 7-P usually double, sometimes triple or 4 branched; 8-P usually double, sometimes triple or 4 branched; 14-P single; 3-M single; 4-M double; 8-M 6–8 branched; 9-M and 9-T 5–6 branched; 7-T 7–10 branched; 12-T single; 13-T 3–7 branched. Abdomen: Segment I–IV: Integument glabrous; setae 6-I and 6-II usually 4 branched, sometimes 3; 7-I double, sometimes triple;

1-III to 1-VI strong, 0.50–0.75 of seta 6-III to 6-VI, 1-III and 1-IV usually single, sometimes double; 1-V and 1-VI double; 6-III to 6-VI all double. Segment VII: Seta 1-VII 3–4 branched; 3-, 7-, 10- and 12-VII single; 4-VII single or double. Segment VIII: Lightly spiculate; comb scales 30–40, all broad, short, subequal, apical fringe rounded, composed of evenly fine spicules; seta 1-VIII 5–6 branched; 2-VIII and 4-VIII single; 3-VIII 7–8 branched; 5-VII 4 branched. Saddle complete, pigmentation whitish or light yellowish; spiculation and sculpture practically absent or poorly developed; posterior caudal margin weakly spiculate; seta 1-X single, very distinct; 2-X with 1 short and 1 long branch; 3-X single; 4-X (ventral brush) consists of 6 pairs of setae, all inserted within grid; anal gills stout, apex pointed, as long as or slightly longer than saddle length. Siphon: Rather stout and thick, somewhat fusiform; acus present, blackish, tube yellowish with variable amount of brownish tinge; pecten teeth developed, 6–12 in a ventral lateral row from base to about 0.3 of total length of siphon; 3–4 distal teeth with 3 graded strong basal denticles and 1 spinelike apical denticle; siphonal tufts 4 pairs (total 8), placed beyond pecten; 2 proximal pairs strong, subequal, 6–8 branched, as long as siphonal width at point of attachment; 2 distal pairs reduced, 4–6 branched; most distal pair placed subventrally, the other more proximal, laterally; seta 2-S pale, single, spiniform; median caudal filament of spiracular apparatus developed and distinct.

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